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Ubiquitous UAV's

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“Ubiquitous UAV’s”

Remote-control model aircraft are familiar to most and have been around for years. “Drones” are a modern, and technologically sophisticated, form of remote-control model aircraft. Most of us associate “Drones” with the large pilotless aircraft used for military purposes in places like Pakistan. There is another type of “Drone” referred-to as an Unmanned Aerial Vehicle (UAV) or, more correctly, a Remotely Piloted Aircraft System (RPAS) that is of interest to the professional surveyor.

UAV’s, in the surveying context, are small and very light remotely-controlled aircraft, either fixed wing or multi-rotor, that typically carry a downward-looking camera. Advances in miniaturisation have enabled these aircraft to be fitted with GPS, Inertial Measurement Units (IMU’s), robotic control systems and telemetry links while weighing around 1 kg. The result is that an operator on the ground can remotely control the aircraft while viewing on a laptop the imagery being captured by the camera. Photography of the ground can then be captured by the operator on command. Autonomous flight and image capture is also possible whereby a flight path, and required photograph locations, are selected on the laptop against a Google Earth background and this information is uploaded to the aircraft memory. After take-off, the aircraft flies directly to, and then along, the predetermined flight path and takes the required photographs. Sophisticated on-board control systems ensure that the aircraft maintains the predetermined flight path and elevation at all times despite any buffeting from the wind. Associated software on the laptop can be used subsequently to stitch adjacent photographs to form a mosaic. The desired landing spot can also be dialled-in and that is exactly where the aircraft will land. Any reasonably flat open ground is suitable for take-off and landings. The simplicity, speed and flexibility of UAV’s sets them apart from conventional aircraft for acquiring aerial photography. Uses for these UAV’s that might interest surveyors include capturing a birds-eye view of a property for sales promotion, checking boundaries, topographical mapping and contouring, generation of orthophotos, recording flood extents and providing measure-ups on quarries, earthworks projects, stockpiles, etc. Under ideal conditions (optimal combination of flying height, camera resolution, ground control, etc.) positional and height accuracies of better than 5 cm are possible.

In addition to fixed-wing aircraft, there are also multi-rotor systems, sometimes referred-to as multicopters, that can hover very precisely and can be operated indoors or outdoors. They are particularly useful for mapping small areas or inspecting difficult to reach parts of buildings, bridges or other structures. With both systems, further applications are possible by replacing the regular camera with a thermal or infra-red camera.

There is a strict legislative framework that controls the use of UAV’s which is controlled in Ireland by the Irish Aviation Authority (IAA). For UAV’s weighing less than 20 kg, including payload, the principal regulations are that

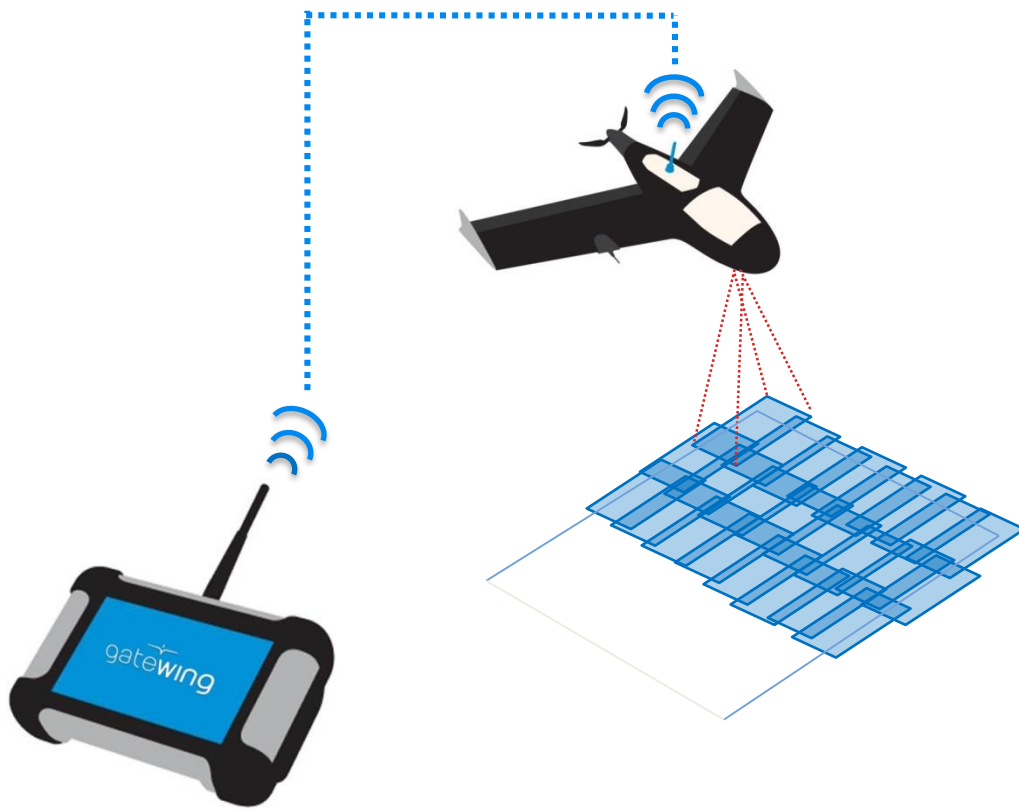
- (i) The operator must be licensed by the IAA
- (ii) Visual line of sight must be maintained by the operator on the aircraft
- (iii) The aircraft must always be within 500 m of the operator
- (iv) The aircraft must not be operated more than 120 m above ground level
- (v) The aircraft can only be operated in congested areas with special permission from the IAA
- (vi) The aircraft must not be operated within 150 m of third parties on the ground

- (vii) The aircraft can only be operated in 'controlled airspace' with special permission from the IAA

In Ireland, there are currently 25 individuals licensed to operate UAV's, with a further 15 awaiting licensing, and they offer UAV services on a commercial basis. The current regulations are designed with the safety of the public in mind but undoubtedly restrict the use of UAV's. Internationally, and in Ireland, there are moves to revise the regulations governing the use of UAV's to enable the enormous potential of these aircraft to be more easily realised. When this happens, it is anticipated that larger UAV's, capable of carrying heavier payloads, will be developed for commercial applications. The smaller UAV's described above cost in the region of €10,000 but the larger UAV's under development could cost closer to €100,000. Looking beyond surveying, UAV's have so much potential in so many disparate areas, for example agriculture, forestry, surveillance and crowd control, that within ten years they will be ubiquitous. Who knows, Amazon's vision of UAV's delivering packages to your door might not be too far-fetched!



UAV flight path log including take-off and landing. (Copyright status unknown)



UAV control system (Can be reproduced)



Mutlicopter (copyright status unknown)